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Case report

CSF rhinorrhoea post COVID-19 swab: A case report and review of literature

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ABSTRACT

We report the case of a 59 year old male who presented with 2 months of persistent rhinorrhoea from left nostril post a nasal swab done for coryzal symptoms at the peak of the COVID-19 pandemic. Beta-2-transferrin confirmed it to be a CSF leak and imaging showed a left middle cranial fossa encephalocele herniating into the sphenoid sinus as the site of the leak post swab. The leak was treated endoscopically. We describe the case history and management of this exceedingly rare complication of nasal swab for respiratory testing.

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1. Background

CSF leaks can be categorized based on aetiology, anatomic site, age of patient, or underlying ICP. Historically, accidental trauma from closed head injury (CHI) is the most common aetiology of CSF leaks, and they occur in approximately 1%–3% of all CHI. Traumatic CSF leaks usually begin within 48 h, and 95% of them manifest within 3 months of injury [1].

The coronavirus pandemic as of March 2020 has brought the world to a standstill. One of the pillars of management and containment of the pandemic is community testing. To date, over 9 million tests have been conducted in Australia. Of those tests conducted, less than 1% have been positive [2]. Nasopharyngeal swab is one of the 4 recognised methods of testing and most commonly instigated; others being saliva, sputum and blood [3]. The alternative upper airway testing method is bilateral deep nasal and oropharynx swab which has now become standard of practise.

CSF leak post nasal swab for COVID-19 has only been reported once in the literature. The case was of a woman in a 40 s presenting with a unilateral rhinorrhoea, headache and neck stiffness post nasal swab as part of screening prior to elective surgery. The patient had a background of idiopathic intracranial hypertension and previous nasal surgery for polyp removal. The fluid was confirmed to be CSF via B-2-transferrin assay. A CT and MRI confirmed an encephalocele extending through the right ethmoid fovea into the middle meatus and a right sphenoid wing pseudo meningocele. The patient underwent endoscopic repair of CSF leak [4].

2. Case presentation

A 59 year old male presented to ED in July 2020 with unilateral rhinorrhoea present for 2 months. He previously had presented to ED in May 2020 with a runny nose from both nostrils and cough. He was sent to Liverpool hospital COVID clinic for a nasopharyngeal swab. The test was conducted by a registered nurse and it was negative. The patient represented because his flu like symptoms subsided but the rhinorrhoea from his left nostril persisted.

His past medical history was significant for hypertension, type 2 diabetes melitus and dyslipidaemia. He denied any history of major skull base trauma, recurrent sinusitis, meningitis or previous nasal/sinus surgery. He denied any headaches or raised ICP symptoms.

Clinical exam revealed persistent nasal discharge of clear fluid on bending forward from the left nostril. The rate of fluid egress increased with valsalva.

His case was discussed with the on-call ENT specialists and they requested a beta-2-transferrin as well as a CT brain and sinuses. The CT brain showed a communication between the left middle cranial fossa with the left sphenoid sinus via a defect in the lateral wall of the sella turcica with the left temporal horn being drawn through the defect Fig. 1. His beta-2-transferrin returned as positive and the patient was referred to neurosurgery for combined management.

He was promptly referred to ophthalmology for formal visual testing and fundoscopy which showed no findings consistent with raised ICP. His MRI subsequently confirmed a skull base defect in middle cranial fossa with an encephalocele herniating through it. It appeared that the temporal horn was being drawn through the

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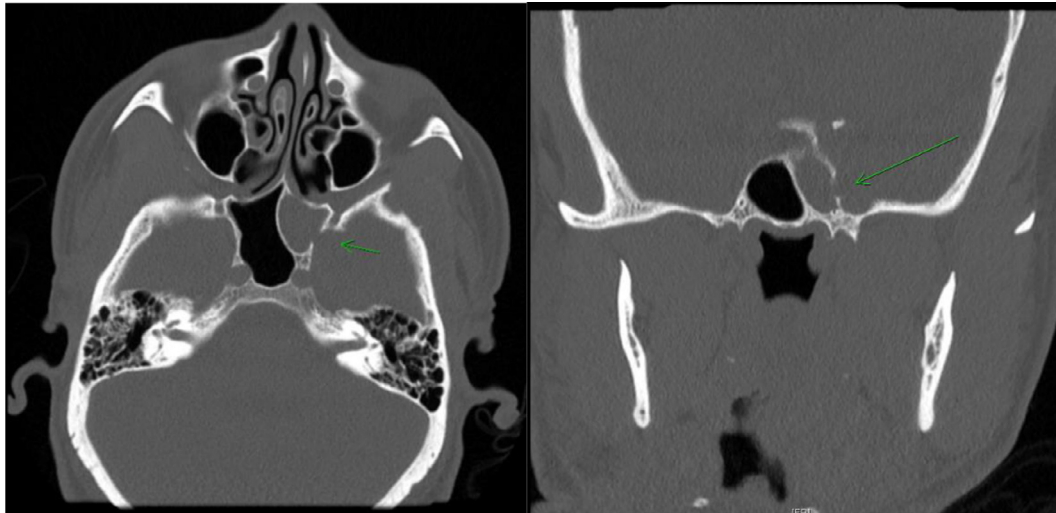


Fig. 1. Axial and Coronal sequence CT scan bony window with green arrow showing LEFT sphenoid sinus dehiscence communicating with middle cranial fossa. Opacification of left sphenoid sinus noted.

defect as well [Fig. 2](#). He underwent a traumatic LP which showed an opening pressure of 5 cm H₂O with 780 red cells and 2 white cells with a 50/50 differential for polymorphonuclear cells and mononuclear cells there was no organisms noted on gram stain as well as extended PCR. Given the lack of raised pressure symptoms in history and exam as well as low opening pressure, the patient underwent excision of encephalocele and skull base repair endoscopically with a vascularised nasoseptal flap without any plans for permanent CSF diversion. The operative specimen resected from the sphenoid sinus contained a mixture of mature astrocytes and neurones with reactive microglia confirming the clinical diagnosis of encephalocele. The patient was discharged day 1 with oral antibiotics. He remained asymptomatic for 25 days then had recurrence of CSF leak with associated headaches. This required repeat endoscopic repair with placement of a dumbbell fat graft and instillation of a lumbar drain. The lumbar drain remained till day 4 and then removed the patient was discharged

day 6 with no leak. The patient remained asymptomatic with no leak at 2 month follow up.

3. Discussion

Iatrogenic CSF leaks most commonly occur after nasal surgery with damage to the cribriform plate being the most common cause [\[5\]](#).

Directions for the safe collection of nasal swabs has been made available through multiple health organisations. The current recommended mode of swab collection in Australia is the bilateral deep nasal and oral swab which replaced the nasopharyngeal swab as preferred collection method on the 1st of April as per the Public health laboratory network (PLHN) guidance. The PLHN guidance was adapted from the United States Centre for Disease Control (CDC) guidelines.

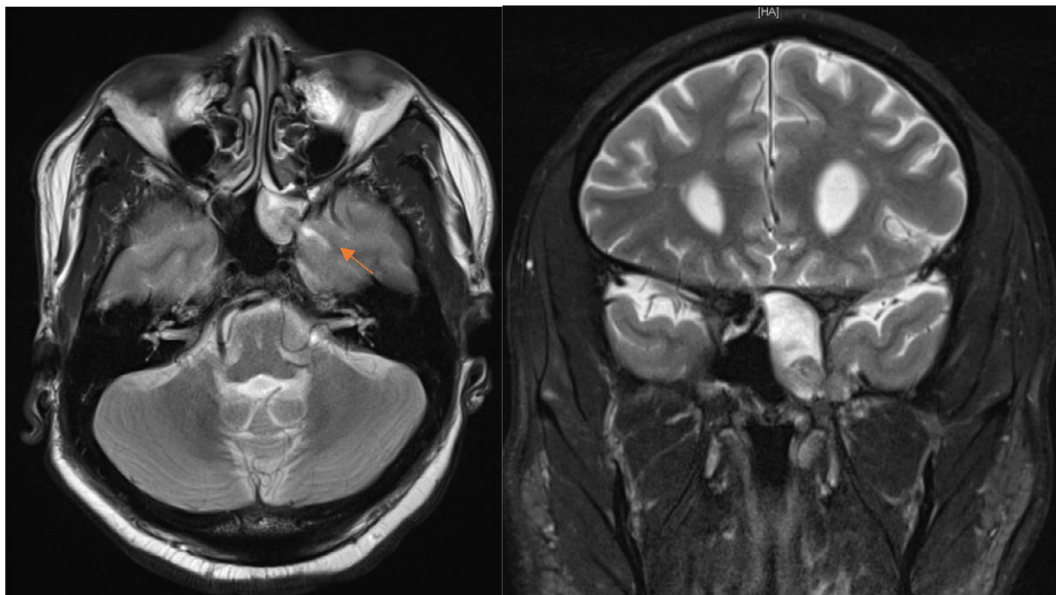


Fig. 2. Axial and Coronal T2 sequence MRI showing encephalocele herniating through sphenoid defect into sphenoid sinus with surrounding T2 hyperintensity (CSF) note orange arrow in axial denoting temporal horn being drawn into encephalocele.

The described method involves the patients head being tilted up and rested against a wall (CDC recommendation for head tilt is 70°) with the swab being inserted parallel to the palate to a depth of 2–3 cm until resistance is met. Prior to 1st of April the nasopharyngeal swab and oral swab was described which involved a swab being inserted parallel to the nasal floor from a line drawn from the nasal ala to the ear lobe, note no depth is specified in this case. The authors feel that improper technique where the swab is not entered parallel to the palate due to parallax error from head tilt compounded with the depth of insertion for a nasopharyngeal swab increases the risk of complications. The average distance from the nasal opening to the sphenoid ostium in cadaveric specimens was 6.2 cm and was reached at an angle of 34.3° , the average height from the palate to the anterior skull base is 4.5 cm [6]. With most of commercially available swabs exceeding these dimensions (Fig. 3A) improperly directed swabs can cause mucosal damage as well potential damage to the skull base.

Encephaloceles within the sphenoid sinus (SS) are subdivided by their location into a medial, peri-sellar type and a lateral, sphenoid recess type. The lateral sphenoidal type is exceedingly rare. Congenital abnormalities of the SS are likely to occur at the fusion

plane of the ossified cartilaginous precursors of the sphenoid bone during development. It acts as a weak spot of the skull base, which may lead to development of a temporal lobe encephalocele protruding into the lateral recess of the SS.

In this case as in the previously documented case in the literature it is believed that the patient had a pre-existing defect and the nasal swab inserted at an incorrect angle and depth disrupted the mucosa surrounding the encephalocele causing the CSF leak.

4. Conclusions

This case showcases that despite samples being obtained by medical professions, adverse events may still occur and highlights the importance of education for safe administration of nasal swabs with understanding of the nasal anatomy as well. The Public Health Laboratory Network recommendation of inserting the swab 2–3 cm or “until resistance is met” as well as confounding information about nasopharyngeal swab collection with head tilt may lead to increased complications, especially in specific populations (previous skull base surgery/trauma, history predisposing patient to

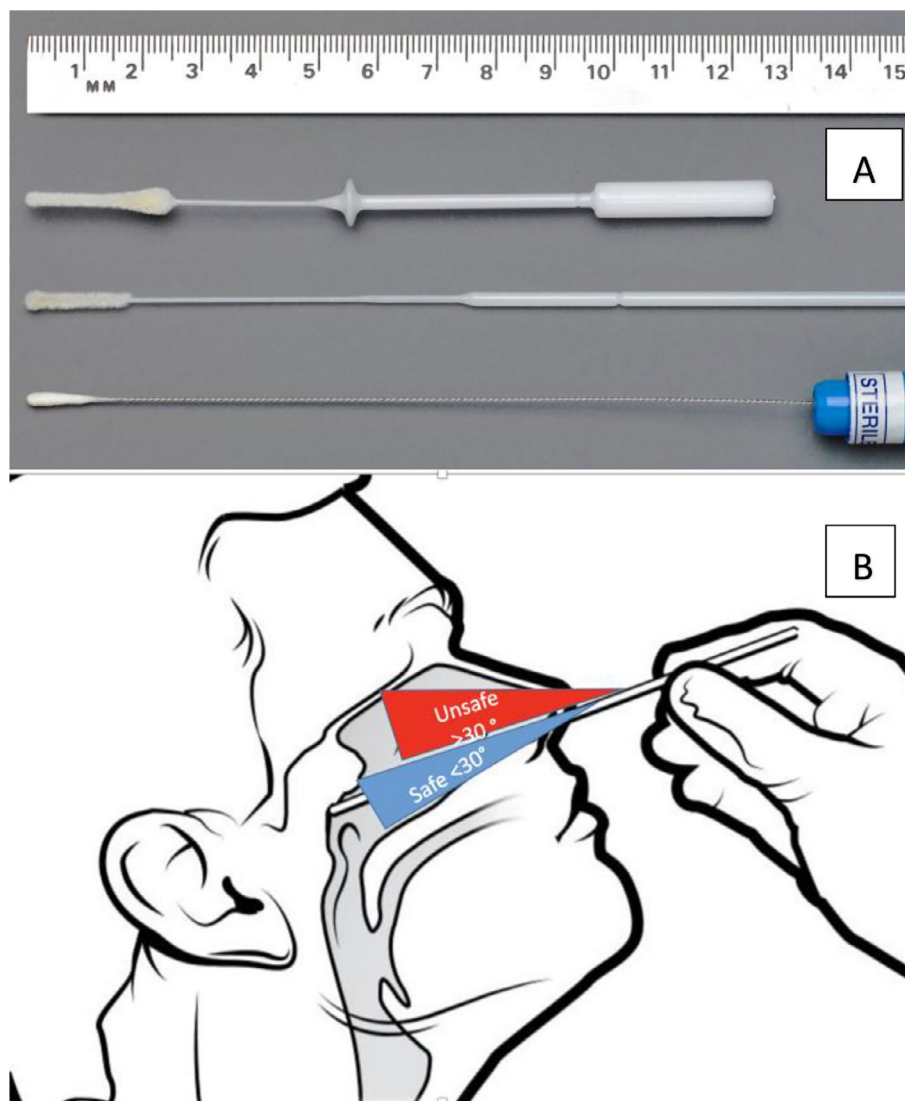


Fig. 3. A: Examples of some commercially available nasal and nasopharyngeal swabs with ruler as reference. B: Diagram depicting safe (blue triangle) as well as unsafe (red triangle) trajectories of nasal swab with corresponding angles. The average depth to the nasopharyngeal wall is 8.2 cm. The angle and depth to the sphenoid ostium is 32.5° and 6.2 cm respectively [7,8].

increased risk of skull base erosion e.g. IIH). Education about safe angles and depths of insertion (Fig. 3B) as well as an understanding of potential complications will reduce the overall risk profile of this necessary testing modality in a pandemic.

5. Ethics statement

This case report was compiled post informed consent from the patient about relaying clinical history and management with view of publication. All attached imaging and clinical material was de-identified to ensure patient anonymity.

Author contributions

J.R collected the data and wrote the paper. J.L edited the manuscript.

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CRediT authorship contribution statement

Jayant Rajah: Writing - review & editing. **Joanna Lee:** Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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